# Clinical overview for pediatric population with SARS-CoV-2 and care: review

*Quadro clínico da população pediátrica com SARS-CoV-2 e cuidados: revisão*

*Cuadro clínico para población pediátrica con SARS-CoV-2 cuidado: revisión*

**RGE** Revista Gaúcha de Enfermagem

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**ABSTRACT**

**Objective:** To identify in the scientific literature the clinical overview of the pediatric population that tested positive for SARS-CoV-2 and care recommendations and recommendations among children who tested positive for SARS-CoV-2 in the scientific literature.

**Method:** Rapid review based on the guidelines of the Joana Briggs Institute: elaboration of the research question, structured search of the literature in April 2020, in nine databases, selection and critical analysis of the eighteen primary studies (using two instruments to assess methodological quality), elaboration of the synthesis, incorporation of suggestions and dissemination.

**Result:** The most frequent clinical overview was respiratory, gastrointestinal symptoms and fever. The images showed irregular frosted glass opacification. It is recommended to screen the pediatric population and family members who show signs and symptoms and to adopt isolation for more than fourteen days.

**Conclusion:** The clinical overview in pediatric population is varied, not exclusively with respiratory symptoms, and a significant number of asymptomatic patients. The importance of new investigations is highlighted, such as randomized clinical trial or cohort studies, identifying their participation in the transmission of COVID-19.

**Keywords:** Child. Coronavirus infections. Signs and symptoms. Respiratory tract diseases.

**RESUMO**

**Objetivo:** Identificar, na literatura científica, o quadro clínico da população pediátrica que testou positivo para SARS-CoV-2 e recomendações de cuidados.

**Método:** Revisão rápida baseada nas diretrizes da Joana Briggs Institute: elaboração da pergunta de investigação, busca estruturada da literatura no mês de abril de 2020, em nove bases de dados, seleção e análise crítica dos dezoito estudos primários (utilizando dois instrumentos para avaliação da qualidade metodológica), elaboração da síntese, incorporação das sugestões e divulgação.

**Resultado:** O quadro clínico mais frequente foi sintomas respiratórios, gastrointestinais e febre. As imagens demonstraram opacificação irregular de vidro fosco. Recomenda-se triagem da população pediátrica e familiares que apresentam sinais e sintomas e adotar isolamento por período superior a quatorze dias.

**Conclusão:** Quadro clínico na população pediátrica é variado, não exclusivamente com sintomas respiratórios, e número significativo de assintomáticos. Destaca-se importância de novas investigações, como ensaios clínicos randomizados ou estudos de coorte, identificando a participação dessas na transmissão da COVID-19.

**Palavras-chave:** Criança. Infecções por coronavirus. Sinais e sintomas. Doenças respiratórias.

**RESUMEN**

**Objetivo:** Identificar en la literatura científica el estado clínico de la población pediátrica que probó positivo para el SARS-CoV-2 y las recomendaciones de atención.

**Método:** Revisión rápida basada en las directrices del Instituto Joana Briggs: elaboración de la pregunta de investigación, búsqueda estructurada de la literatura en abril de 2020, en nueve bases de datos, selección y análisis crítico de los dieciocho estudios primarios (utilizando dos instrumentos para evaluar la calidad metodológica), elaboración de la síntesis, incorporación de sugerencias y difusión.

**Resultado:** El cuadro clínico más frecuente fue respiratorio, síntomas gastrointestinales y fiebre. Las imágenes mostraron opacificación irregular de vidrio esmerilado. Se recomienda evaluar la población pediátrica y familiares que muestran signos y síntomas y adoptar aislamiento durante más de catorce días.

**Conclusiones:** El cuadro clínico en la población pediátrica es variado, no exclusivamente con síntomas respiratorios, y un número importante de pacientes asintomáticos. Se destaca la importancia de nuevas investigaciones, como ensayos clínicos aleatorizados o estudios de cohorte, identificando su participación en la transmisión del COVID-19.

**Palabras clave:** Niño. Infecciones por coronavirus. Signos y síntomas. Enfermedades respiratorias.

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## ■ INTRODUCTION

In December 2019, the World Health Organization (WHO) was alerted to several cases of pneumonia in the city of Wuhan, province of Hubei, People's Republic of China. The following month, Chinese authorities confirmed that they had identified a new type of coronavirus named SARS-CoV-2, which causes the COVID-19 disease[1].

On March 11, 2020, the WHO, after assessing the spread of the virus, issued situation report 51 and declared that COVID-19 can be characterized as a pandemic[2]. Since then, it can be stated that "the COVID-19 pandemic represents one of the greatest global health challenges of this century"[3].

SARS-CoV-2 is an emerging contagious pathogen that causes a high incidence of pneumonia in infected individuals. Thus, it is critical to learn more about the clinical characteristics in pediatric patients to diagnose and effectively treat this disease in this population[4].

Recent epidemiological data consistently suggest that children and adolescents are the minority of diagnosed COVID-19 cases. The WHO defines children as individuals between 0 and 9 years of age and adolescents as individuals between 10 and 19 years of age. However, the WHO also states that most adolescents are included as "child" based on the age adopted by the Convention on the Rights of the Child[5]. Thus, considering that the publications on this population in the SARS-CoV-2 pandemic do not distinguish by age classification, the terminology "pediatric population" was adopted to classify children and adolescents affected by COVID-19.

A study[6] found that children account for 1% to 5% of confirmed cases. In Canada, on April 25, children under the age of 19 accounted for 4.7% of confirmed cases[7]. In the United States of America (USA), children accounted for only 1.7% of all cases[8]. On April 15, the Korea Disease Control and Prevention Agency tested a fairly representative population. Of all the individuals that tested positive for COVID-19, 6.49% were children under 19 years old (1.25% aged 0-9 years and 5.37% aged 10-19)[9]. Data from Latin American countries are not yet widely available. In Brazil, among the confirmed COVID-19 deaths, 0.7% were individuals under 19 years of age, on April 26, according to data of the epidemiological bulletin of the Secretariat of Health Inspection[10].

In a case series involving 1,391 children at the Wuhan Children's Hospital, 171 (12.3%) were diagnosed with SARS-CoV-2 and mostly presented with fever, cough, and pharyngeal erythema; moreover, the most frequent radiological finding among these confirmed cases was bilateral ground-glass opacity (32.7%)[11]. In another study conducted in the Zhejiang province of China, the main clinical characteristics of COVID-19 in children were fever, dry cough, and pneumonia[4].

Although the pediatric population is not the highest risk group for COVID-19, the physical consequences and those arising from preventive measures such as social distancing and isolation have directly affected their mental health and access to preventive actions, such as immunization, thus making this group more vulnerable[12–13]. Given the challenges involved in reaching the Global Sustainable Development Goals 2015-2030 established by the United Nations Organization, the achievement of goal 3 (ensuring a healthy life and well-being for all, at all ages)[14] demands further studies and the systemization of available data to guide health actions and, in particular, the practices of nursing professionals.

A large-scale national study with 115 pediatric cases concluded that "knowledge of the particular characteristics of clinical manifestations in children can contribute to the diagnosis and management of COVID-19 cases in children and adolescents"[15].

A multicenter research trial conducted with 409 children from Latin American countries revealed a generally more severe form of COVID-19 and a high rate of multisystem inflammatory syndrome compared to other regions of the world, thus highlighting the urgency of more studies on the subject[16].

The current scenario justifies the need for this review to synthesize the clinical manifestations of COVID-19 in the pediatric population with the aim of guiding the clinical practice of health professionals during this pandemic and contributing to the establishment of health care. In this regard, the following guiding questions were observed: what is the clinical status of the pediatric population attended in health care facilities that led to RT-PCR testing and possible detection of SARS-CoV-2 RNA? What are the care recommendations for this group? The aim was to identify, in the scientific literature, the clinical status of the pediatric population that tested positive for SARS-CoV-2 and recommendations for care.

Given the above, in the current context of the pandemic triggered by the novel coronavirus, the systematization of information for the construction of scientific evidence is essential for decision-making, recommendations, elaboration and execution of health education actions, and professional health care training.

## ■ METHOD

This is a rapid review based on bibliographic database searches[17–18]. A rapid review is characterized as an efficient methodological proposal for government, clinical, and/or emergency decision-making and currently considered useful to organize information on the manifestation of COVID-19 in the pediatric population.

The databases of the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and the Medical Literature Analysis and Retrieval System Online (MEDLINE) were consulted and no systematic reviews were found on the general clinical status of children with COVID-19; moreover, a protocol for a systematic review registered in the archives of the Joanna Briggs Institute (JBI) and in the international database of prospectively registered systematic reviews (PROSPERO) was absent.

Thus, the proposal of the six methodological guidelines for rapid review (RR) was adopted, created by the Joanna Briggs Institute (JBI)[19], which consists of setting the research question, specifying literature selection methods, detailing the data extraction procedure, evaluating the results according to their pertinence and validity, critical analysis, and synthesis of the conclusions. For the first guideline, the research question was based on the PICO strategy[20], in which P (patient population) refers to the pediatric population submitted to RT-PCR (reverse-transcriptase polymerase chain reaction) testing, leading to detection of SARS-CoV-2 RNA; I (intervention) refers to the clinical status of the pediatric population and recommendations for care; C (comparison) not applicable; and O (outcomes) refers to established conduct and interventions. Therefore, the following guiding questions were elaborated for the present study: what is the clinical status of the pediatric population attended in health care facilities, which led to RT-PCR testing, and was SARS-CoV-2 RNA detected? What are the care recommendations for this group?

Then, the search strategies were established, according to the specific characteristics of each database, in order to obtain the largest possible number of primary studies of interest. The inclusion criteria were scientific articles on the clinical status of the pediatric population attended in health care facilities who tested positive (RT-PCR) for the novel coronavirus; participants of the investigated studies under the age of 19 years, with or without pre-existing comorbidities; reports of primary cases and case series published from 2019 to 2020, without language restriction, and studies with human participants. Systematic reviews and grey literature were excluded.

The search terms were words or expressions that comprised health-based descriptors (controlled words), which served as a reference for the database searches, leading to replacement of the keyword "pediatric population" with "Infant, Newborn" or "Infant" or "Child, Preschool" since production on the subject does not differentiate results by age groups. Each database search involved a different strategy that allowed the largest collection of articles and included the Boolean operators AND and OR for combination. The searched databases were Virtual Health Library ("BVS"), Latin America and the Caribbean Literature on Health Sciences ("LILACS") via BVS, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PUBMED, Web of Science, Scientific Electronic Library Online (SCIELO), EMBASE, Medline via Pubmed, and IBECS via BVS (Chart 1).

The guideline that corresponds to the selection and critical analysis of the studies was subdivided into stages. Searching and selection were performed by one of the authors, a neonatology nurse, initially on April 20, followed by May 02, 2020, with application of the inclusion criteria and use of the flow diagram PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)[21] (Figure 1). All selected references were entered into Mendeley® software to identify duplicate articles.

The methodological quality of the studies was assessed by the authors with expertise in epidemiology using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for case reports[19] and the Institute of Health Economics (IHE) quality appraisal checklist for assessing case series[22]. The first tool evaluates the methodological quality of case reports and the second tool evaluates the methodological quality of case series. The quality of the studies was classified using the following categories: low (score up to 49.0%), moderate (score between 50.0% and 70.0%), and high (score above 70.0%)[23].

The selected articles were critically analyzed through data extraction using an instrument built by the team with the following information: reference, country, objective, methodological factors (type of study, participants, *locus*, collection instruments, ethical aspects, and analysis proposal), results (profile of participants, clinical manifestations, type and results of diagnostic tests, interventions, and outcome), and recommendations or implications.

The data synthesis for the primary studies was prepared from the complete and impartial interpretation of these studies. The presentation comprised a quantitative description of the identified findings, justification of exclusions after reading the title, abstract and full text, and final sample. Then, the charts, figure, and table of results were created and presented. Finally, the methodological limitations of the rapid review were reported.

The ethical aspects were observed by duly registering the references with year of publication of the study and by

| DATABASE | STRATEGY | No. of Articles 1st search 04/20/2020 | No. of Articles 2nd search 05/02/2020 |
|---|---|---|---|
| MEDLINE via BVS | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant, Newborn" or "Infant" or "Child, Preschool" | 177 | 370 |
| LILACS via BVS | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant, Newborn" or "Infant" or "Child, Preschool" | 11 | 22 |
| SCIELO | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant, Newborn" | 0 | 0 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant" | 0 | 0 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Child, Preschool" | 0 | 0 |
| PubMed | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant, Newborn | 2 | 3 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant" | 13 | 14 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Child, Preschool" | 1 | 3 |
| CINAHL | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant, Newborn" | 4 | 7 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant" | 4 | 7 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Child, Preschool" | 4 | 6 |
| IBECS via BVS | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant, Newborn" or "Infant" or "Child, Preschool" | 2 | 11 |
| EMBASE | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant" | 1 | 1 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Infant, Newborn" | 1 | 1 |
| | "Coronavirus Infections" and "Humans" and "Signs and Symptoms" and "Child, Preschool" | 0 | 0 |
| Web Of Science | "Coronavirus Infections" and "Infant, Newborn" | 0 | 0 |
| | "Coronavirus Infections" and "Infant" | 3 | 8 |
| | "Coronavirus Infections" and "Child, Preschool" | 0 | 0 |
| | "Coronavirus Infections" and "Child" | 5 | 7 |

**Chart 1** – Strategies used to search the bibliographic databases and frequency of references
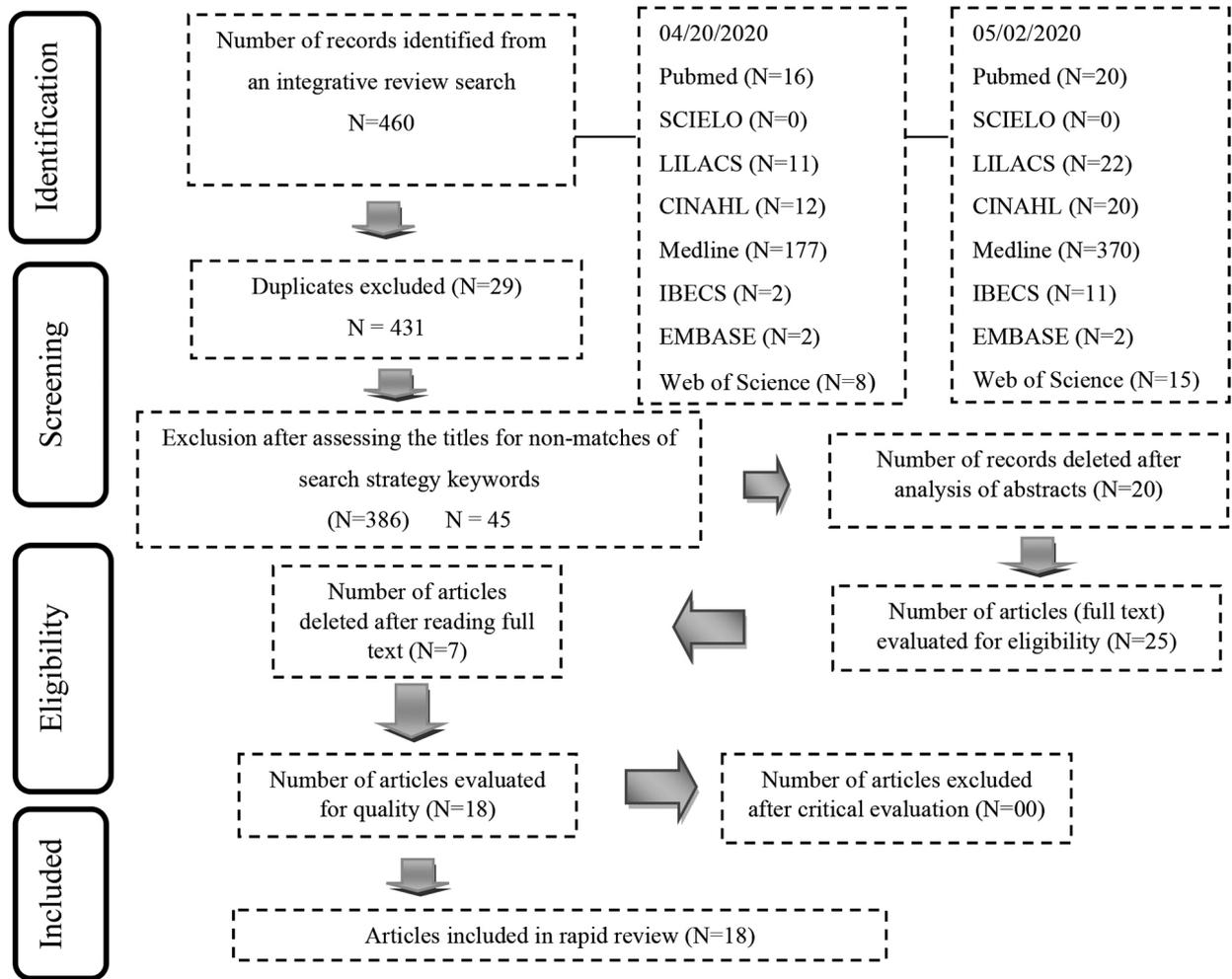Source: Authors, 2020.

**Figure 1** – Identification, selection, and inclusion of studies in the review of the primary study selection process
Source: Authors, 2020.

maintaining the ideas of the authors of the publications used in the development of this study.

■ **RESULTS**

In the rapid review, 228 articles were identified on April 20, and 232 articles were identified on May 02, 2020, from the systematic search on the established databases. In the investigated period, the following number of articles were found: 20 in PUBMED, 0 in SCIELO, 22 in LILACS via Virtual Health Library ("BVS"), 20 in CINAHL, 370 Medline, 11 in IBECS via BVS, 2 in EMBASE, and 15 in Web of Science. Among these studies, 29 articles were excluded due to duplication and 386 were excluded because the title did not match the keywords of the research strategy, resulting in 45 articles in this stage. After reading the abstracts, 20 articles were

excluded and after reading the full text, 7 articles were eliminated, based on the inclusion and exclusion criteria.

The studies included after application of all the criteria totaled 18. Of these articles, 9 were case reports[24–32] and 9 were case series[33–41] and they were all based on methodologies with descriptive quantitative approaches. The studies were conducted in China (13), Korea (1), Italy (1), Lebanon (1), Iran (1), and Spain (1). Most of the studies were written in English (14), 3 in Mandarin, and 1 in Spanish. The *locus* of all the studies were hospitals and the data collection instruments were observation and case records. Regarding the ethical aspects, 7 articles[28,33–36,39–40] included information on the protocols, while 11 did not report any procedures[24–27,29–32,37–38,41]. The data of 208 children, aged from 1 day to 15 years, were analyzed, as shown in Table 1.

**Table 1** – Strategies used to search the bibliographic database and frequency of references

| Author | Country of study | Type of study | N | Age | Sex |
|---|---|---|---|---|---|
| Alonso Díaz et al.[26] | Spain | Case report | 1 | 8 days | Female |
| Canarutto et al.[25] | Italy | Case report | 1 | 32 days | Male |
| Feng et al.[33] | China | Case series | 15 | 4 to 14 years | Male (5) Female (10) |
| Kamali Aghdam et al.[24] | Iran | Case report | 1 | 15 days | Male |
| Li et al.[34] | China | Case series | 5 | 10 months to 6 years | Female |
| Li et al.[30] | China | Case report | 2 | 4 years | Male (1) Female (1) |
| Lin et al.[27] | China | Case report | 1 | 7 years | Female |
| Liu et al.[35] | China | Case series | 6 | 1 to 7 years | Male (2) Female (4) |
| Ma et al.[41] | China | Case series | 115 | 51 days to 15 years | Male (73) Female (42) |
| Mansour et al.[31] | Lebanon | Case report | 1 | 16 months | Female |
| Park et al.[28] | South Korea | Case report | 1 | 10 years | Female |
| Shi et al.[36] | China | Case series | 10 | 7 months to 11 years | Male (5) Female (5) |
| Su et al.[37] | China | Case series | 9 | 11 months to 9 years | Male (3) Female (6) |
| Sun et al.[39] | China | Case series | 8 | 2 months to 15 years | Male (6) Female (2) |
| Xia et al.[40] | China | Case series | 20 | 1 day to 14 years | Male (13) Female (7) |
| Xu et al.[38] | China | Case series | 10 | 2 months to 15 years | Male (6) Female (4) |
| Zeng et al.[29] | China | Case report | 1 | 17 days | Male |
| Zhang et al.[32] | China | Case report | 1 | 3 months | - |

Source: Authors, 2020.

In the methodological quality assessment, only one study presented low methodological quality, with a score of 28.6%[30]. In all, 17 studies showed high methodological quality: 3 reached 100.0%[27–28,31], 1 reached 90.0%[39], 2 reached 85.7%[26,29], 2 reached 82.5%[35,37], 2 reached 80.0%[36,38], 1 totaled 77.5%[34], 1 reached 75.0%[33], 1 obtained 72.5%[40–41], and 2 reached 71.4%[24–25] (Chart 2).

| JBI Critical Appraisal Checklist for case reports | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Study** | ***Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q6** | **Q7** | **Q8** | **SCORE** | **Quality** |
| Alonso Díaz et al.[26] | *S | Y | Y | Y | Y | *N | *NA | Y | 85.7% | High |
| Canarutto et al.[25] | Y | N | Y | Y | N | Y | NA | Y | 71.4% | High |
| Kamali Aghdam et al.[24] | Y | N | Y | Y | N | Y | NA | Y | 71.4% | High |
| Li et al.[30] | N | N | Y | Y | N | N | NA | N | 28.6% | Low |
| Lin et al.[27] | Y | Y | Y | Y | Y | Y | NA | Y | 100.0% | High |
| Mansour et al.[31] | Y | Y | Y | Y | Y | Y | NA | Y | 100.0% | High |
| Park et al.[28] | Y | Y | Y | Y | Y | Y | NA | Y | 100.0% | High |
| Zeng et al.[29] | Y | Y | Y | Y | Y | N | NA | Y | 85.7% | High |
| Zhang et al.[32] | Y | N | Y | Y | *U | N | NA | Y | 57.1% | Moderate |

| IHE Quality Appraisal Checklist for case series | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q6** | **Q7** | **Q8** | **Q9** | **Q10** | **Q11** | **Q12** | **Q13** | **Q14** | **Q15** | **Q16** | **Q17** | **Q18** | **Q19** | **Q20** | **SCORE** | **Quality** |
| Feng et al.[33] | Y | N | N | *P | Y | P | P | Y | N | Y | Y | Y | Y | Y | Y | Y | P | Y | Y | Y | 75.0% | High |
| Li et al.[34] | Y | P | N | P | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | Y | P | 77.5% | High |
| Liu et al.[35] | N | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | P | Y | Y | Y | Y | N | Y | Y | 82.5% | High |
| Ma et al.[41] | Y | N | N | P | Y | P | P | Y | Y | Y | Y | Y | P | Y | P | Y | Y | Y | Y | N | 72.5% | High |
| Shi et al.[36] | Y | Y | N | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | P | Y | N | P | Y | 80.0% | High |
| Su et al.[37] | Y | N | N | P | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 82.5% | High |
| Sun et al.[39] | Y | P | N | P | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 90.0% | High |
| Xia et al.[40] | Y | Y | N | P | Y | P | P | Y | Y | Y | Y | Y | P | P | P | Y | N | Y | Y | P | 72.5% | High |
| Xu et al.[38] | Y | P | N | P | Y | P | P | Y | Y | Y | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | 80.0% | High |

**Chart 2** – Methodological quality assessment
Source: Authors, 2020.
* Question (Q); Uncertain (U); No (N); Yes (Y); Not applicable (NA); Partial (P).

Of the analyzed articles, the children mostly presented with the following clinical manifestations: respiratory symptoms (cough, runny nose, nasal congestion, rhinitis, polypnea, and rumbling auscultation) 114/208, followed by fever 72/208; gastrointestinal symptoms (nausea, vomiting, diarrhea, constipation) 24/208; sore throat 5/208; chest pain 2/208; headache 1/208; lethargy 1/208; and skin spots 1/208. There were 94 asymptomatic children (Chart 3).

| Author | Imaging | Clinical status | Recommendations |
|---|---|---|---|
| Alonso Díaz et al.[26] | - | Asymptomatic; Severe double pneumonia; Intermittent polypnea; Mild intercostal drainage; Self-limiting oxygen desaturations | Conducting further studies with newborns; Carrying out new collections, when the PCR of the nasopharynx is negative, if a patient has a high index of suspicion for COVID-19 virus infection |
| Canarutto et al.[25] | - | Fever; Rhinitis; Cough | Maintaining a very low index of suspicion in children with symptoms, even in the absence of contact with confirmed cases of COVID-19, in all countries affected by the outbreak; The management of children affected by COVID-19 should be dictated by clinical conditions, limiting hospitalization when possible; Conducting routine chest CT in children |
| Feng et al.[33] | Chest CT | Asymptomatic; Fever; Nasal congestion; Cough | Screening of cases of infection with epidemiological history; Adoption of RT-PCR as one of the diagnostic criteria; Using chest CT as the first choice for screening images of children with suspected COVID-19 virus infection |
| Kamali Aghdam et al.[24] | Chest x-ray Echocardiogram | Fever; Lethargy; Skin spots; Difficulty breathing | Conducting PCR tests for SARS-CoV-2 in newborns with nonspecific clinical and laboratory symptoms of infection with parents with a history of COVID-19 |
| Li et al.[34] | Chest CT | Asymptomatic; Fever; Cough; Runny nose; Sore throat | Chest CT to assist in the diagnosis of COVID-19 |
| Li et al.[30] | Chest CT | Asymptomatic; Cough; Runny nose; Dyspnea | Conducting further studies on clinical manifestations in children; Performing PCR and chest CT for diagnosis, associated with child and family history and possible contact with infected individuals and clinical manifestations |
| Lin et al.[27] | Chest CT | Asymptomatic | Conducting additional research with large samples to investigate the characteristics of children infected with SARS-CoV-2; Adopting an isolation period of more than 14 days for children |
| Liu et al.[35] | Chest x-ray Chest CT | Fever; Cough; Vomiting. | - |

**Chart 3** – Imaging, clinical status, and recommendations addressed in the studies

| Author | Imaging | Clinical status | Recommendations |
|---|---|---|---|
| Ma et al.[41] | Chest CT | Asymptomatic; Fever; Cough; Runny nose; Nasal congestion; Gastrointestinal symptoms; Chest tightness; Chest pain | Performing RT-PCR and chest CT in children living with positive cases of SARS-CoV-2 to verify asymptomatic infection and proceed with isolation; Continuous blood count tests that focus on alterations in white blood cells and lymphocytes; Monitoring alterations in ALT and CK-MB |
| Mansour et al.[31] | Chest X-ray | Fever; Lethargy; Skin spots; Difficulty breathing | - |
| Park et al.[28] | - | Fever; Sputum | Closure of schools to mitigate the spread of COVID-19 in the community; Consider the possible health risks of radiation when computed tomography is needed in children |
| Shi et al.[36] | - | Mild pneumonia; Upper respiratory tract infection | - |
| Su et al.[37] | Chest x-ray Chest CT | Fever; Cough | - |
| Sun et al.[39] | Chest X-ray | Polypnea; Fever; Cough; Sputum; Rumbling auscultation; Nausea/vomiting; Diarrhea; Fatigue/myalgia; Headache; Constipation | Early identification of the specific characteristics of severe pediatric patients and timely treatment |
| Xia et al.[40] | Chest x-ray Echocar-diogram | Fever; Cough; Diarrhea; Runny nose; Sore throat; Moist rales; Vomiting; Tachypnea; Signs of retraction; Cyanosis; Co-infection with other pathogens | Early diagnosis to improve management and clinical treatment of children; Early chest CT |
| Xu et al.[38] | Chest x-ray Chest CT | Asymptomatic; Fever; Cough; Sore throat; Nasal congestion; Runny Nose; Diarrhea | - |

**Chart 3** – Cont.

| Author | Imaging | Clinical status | Recommendations |
|--------|---------|-----------------|-----------------|
| Zeng et al.[29] | Chest x-ray Chest CT | Fever; Diarrhea | Monitoring of anal swabs for nucleic acid test; When there is suspicion or confirmation of COVID-19 in family members or close contacts, attention should be paid to the possibility of asymptomatic and atypical infections in newborns |
| Zhang et al.[32] | - | Fever; Sputum; Cough; Tachycardia | Carrying out PCR for feces and secretions from the nasopharynx even if the PCR for blood is negative in three alternating collections; Testing the family members; Maintaining the child and family members in isolation and follow-up |

**Chart 3** – Cont.
Source: Authors, 2020.

Among the primary case series, the clinical signs presented were respiratory symptoms such as cough, runny nose, nasal congestion, allergic rhinitis, sputum, respiratory distress, polypnea, rumbling auscultation[33,35–41]; and fever[33,35,37–41], as well as gastrointestinal symptoms such as nausea, vomiting, diarrhea, constipation[35,38–41]; sore throat[40]; chest pain[41]; headache[39]; and cases of asymptomatic children[33–34,38,41].

With regard to the case reports with at least two children, respiratory symptoms such as cough, rhinitis, sputum, respiratory distress, difficulty breathing, without coughing or sneezing[24–25,27–28,30–31] were listed, and polypnea occurred on the ninth day of a new-born[26]. Other symptoms included fever[25,28–31], gastrointestinal symptoms such as diarrhea[29], lethargy[31], and skin spots[24,31], and some cases of asymptomatic children[27,30].

The results of the laboratory tests showed alterations in the leukogram. Cultures of nasopharynx[24–33,35,37–41], blood[25,28–29,31–32,38,41], urine[25,27–29,31–32,38], and feces[28–29,31,32,37–38] were also performed. In some cultures, the presence of the virus was detected in the nasopharynx[24–26,28,31–33,35,37–41] and in the feces[28–30,32,37–38].

Regarding alterations identified in computed tomography, the images showed irregular ground-glass opacity in 80 children[29,34,37–41].

The established interventions were hospitalization of the child in isolation ward[24–25,27–28,30–31,33–41] or neonatal/pediatric intensive care unit[26,29,35,39,41], depending on the clinical status. In cases in which the family tested positive for COVID-19, the child remained hospitalized and the family remained in monitored home isolation[31]; the child was discharged after a period of hospitalization and remained in home isolation with the family for 14 days[24–25,27,36]; or the entire family was admitted to hospital[26,28,37].

The outcome of 201 cases was recovery and hospital discharge; however, 5 children were hospitalized again[37] and 2 remained hospitalized for longer than the conclusion of the study[41].

## ■ DISCUSSION

Most of the pediatric population that tested positive for SARS-CoV-2 identified in this review presented with respiratory symptoms, fever, and gastrointestinal symptoms. Similar results were found in other studies[4,8,11]. According to a meta-analysis, COVID-19 manifests itself with a rapid and progressive course of fever, cough, and dyspnea, with similarities to other viral respiratory pathogens[42]. Regarding respiratory symptoms, the centers for disease control and prevention[8] reported cough in 54% and shortness of breath in 13% of pediatric patients. In a study conducted in China with 171 children, cough was identified in 48.5% and pharyngeal erythema in 46.2% of pediatric patients, together with other symptoms[11].

With regard to fever, it was observed that the defining parameters of hyperthermia were heterogeneous. According to one study conducted in China, of the 41.5% of the pediatric patients who presented with fever, 58.5% had a temperature below 37.5°C[11]. A second study also conducted in China found that 36% of children presented with fever based on a reference temperature above 37°C[4]. It is observed that the parameters established for fever do not comply with the WHO reference, in which fever in

children is established with a body temperature equal to or greater than 37.5°C[43].

Gastrointestinal symptoms were also identified in other studies[4,11]. Such symptoms should be further investigated, as they are common in other viral infections of the respiratory tract such as respiratory syncytial virus[44].

A study comparing infections in children by SARS-CoV, MERS-CoV, and SARS-CoV-2 concluded that the clinical, laboratory and radiological characteristics are similar for all referred coronaviruses[45]. This finding can serve as a guideline for the interventions of health workers in the care of the pediatric population with COVID-19.

It is still not clearly understood why most of the pediatric population presents with a mild clinical status, but it is known that there are numerous mechanisms associated with the fields of immunology, anatomy, and virology[46–47]. According to some hypotheses, the innate immune response, which is an early immune response of the organism against microorganisms, is more active in children, so they can fight the virus more quickly, even before presenting any symptoms[28]. Moreover, other scholars have found that SARS-CoV-2 enters cells through specific receptors that are distributed differently by the organism of different populations and, especially in children, the amount and function of these receptors are poorly developed[48].

A study concluded that critical pediatric patients with COVID-19 are still rare, but it also stresses the need for early planning considering an increase in pediatric cases[49].

However, as the pandemic continues to spread, studies reveal greater severity of COVID-19 in the pediatric population, which is now being affected with the most severe form of the disease[15–16], correlated with multisystem inflammatory syndrome.

This rapid review showed that 94 asymptomatic children tested positive for COVID-19, which indicates the need to test this population when these children live with or have contact with symptomatic family members. In a study conducted in Singapore, the case of an asymptomatic infant with a positive nasopharyngeal swab was monitored until the sixteenth day of admission, thus demonstrating the complexity of defining incidence of the disease since asymptomatic people can excrete the virus[50]. In this regard, it is important to fully record symptoms in medical forms to prevent any incompleteness of data that may cause cases to be classified as asymptomatic[8].

Other findings in the studies of this review result from alterations in the leukogram, positive swabs for oropharynx, and feces. On March 19, 2020, the WHO issued a guideline for laboratory tests that should be requested for people suspected of COVID-19 infection[51]. However, the use of different tests in the various countries experiencing the pandemic may make it difficult to compare diagnostic methods. Regarding the rectal swab, a study[38] reported positive test results in eight infected children even after a negative nasopharyngeal swab, which indicates possible fecal-oral transmission[46].

Regarding imaging in all the analyzed studies, chest X-ray and CT scans were the most frequently used methods and provided additional information to define the clinical status of COVID-19 in children and the diagnosis. According to some studies, the clinical manifestations viewed on computed tomography in patients diagnosed with COVID-19 reveal abnormalities, even in asymptomatic patients, with rapid evolution of bilateral and/or unilateral ground-glass opacity[36,52].

Regarding sex, it was not possible to establish whether most of the cases were male or female patients or possible justifications since three articles[32,40–41] did not specify the sex of patients. This information is important to better determine the characteristics of vulnerable groups.

The pediatric population participating in the studies mostly presented with the mild form of the disease and evolved to hospital discharge. This finding corroborates the statements of experts on the evolution of the pathology[46]. A study conducted with French children who presented with signs of severe infection by COVID-19 showed that this population responds positively and quickly against the disease[53].

Although children present with asymptomatic or mild forms of the disease, "they represent a substantial source of infection in the community and may play an important role in viral transmission"[54]. This finding could support strategies to control the transmission chain of SARS-CoV-2[11].

The care interventions for the pediatric population with COVID-19 were hospital admission (in isolation ward, neonatal and pediatric intensive care unit) and home isolation with the family for 14 days. Considering the rapid spread of SARS-CoV-2, isolating children and their families or quarantine are basic public health actions to contain this emerging epidemic[50], prevent overcrowding in health units, and protect risk groups[8]. Moreover, these interventions reduce the speed of transmission and contamination by the virus until more effective preventive and therapeutic measures are developed.

The recommendations identified in the studies of this rapid review can be synthesized in terms of practice and research, as follows: (i) give priority to the early identification of characteristics that are specific to the pediatric population and timely treatment to prevent damage to the lungs in the long-term and serious health-related complications; (ii) track cases of infection in the family disease history; (iii) test

for SARS-CoV-2 using RT-PCR in the pediatric population with a family member who presents symptoms and signs, as children can be asymptomatic; (iv) isolate the pediatric population and their families for more than fourteen days; (v) test of sputum, pus or oropharynx, and feces samples during the course of the disease until all three tests are negative; and (vi) assess the risk of radiation exposure in children when computed tomography is indicated.

It should be noted that five articles[31,35–38] did not specify recommendations, which is considered a limitation of these studies.

The description of ethical standards was limited to a few studies of the review. In this regard, each country is regulated by its own guidelines; however, it is essential to notify precautions that ensure the dignity and integrity of participants, especially in the context of infectious disease outbreaks[55].

Precautions should be taken during breastfeeding, for example, to increase protection against infection, as there is no scientific evidence on the route of transmission to newborns.

Government agencies, health workers, and, in particular, nursing teams should pay extra attention to children in conditions of vulnerability since these conditions, associated with the COVID-19 pandemic, increase the care needs of this population.

In this regard, child primary care should be restructured so as not to suspend assistance provided by children's programs since a study[56] indicates that the non-provision of these services may increase the prevalence of additional deaths by 18% to 23%.

This study contributes to knowledge in the area of child health by identifying the clinical status and recommendations adopted in the international literature for the pediatric population with COVID-19 and, therefore, reveals the initial panorama of the pandemic in this group. Moreover, it provides information that can help health workers and managers establish and implement care protocols for the pediatric population and their families.

## ■ CONCLUSION

The most frequently identified clinical status of the pediatric population that tested positive for SARS-CoV-2 included respiratory signs and symptoms, gastrointestinal symptoms and fever, and a significant number of asymptomatic patients.

Among the recommendations, identification activities, screening, and early treatment based on the epidemiological history of the pediatric population and family members, as well as isolation for more than fourteen days are highlighted.

This rapid review has some limitations. First, the a possible bias in the article selection process since consensus could not be established regarding collection carried out by a single researcher, although this fact characterizes the method. Second, the data limitations made it impossible to differentiate clinical manifestations in the different age groups of the pediatric population.

Further studies, such as randomized clinical trials or cohort studies, should be conducted to identify participation of the pediatric population in the transmission chain of COVID-19, especially regarding fecal-oral transmission of SARS-CoV-2, descriptions of clinical manifestations by pediatric age group, and routes of contamination in newborns and infants, with emphasis on vertical transmission and contamination by breast milk.

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